

CLAIMS

What is claimed is:

- 5           1.     An apparatus for the rapid screening of potential reactants, catalysts or  
            reaction conditions, the apparatus comprising:  
                    a reaction substrate comprising at least one substrate reservoir, said  
            reaction substrate having a first temperature; and  
                    a head plate positioned to provide a sealed headspace adjacent to said  
10     substrate reservoir, said head plate having a second temperature and said headspace  
            having an adjustable pressure.
2.     The apparatus of claim 1, further comprising a controller in  
            communication with said reaction substrate and said head plate, wherein said  
15     controller maintains said reaction substrate at said first temperature and said head  
            plate at said second temperature.
3.     The apparatus of claim 1, further comprising;  
                    a thermal unit in communication with said reaction substrate and  
                    a controller in communication with said reaction substrate and said  
20     head plate, wherein said controller adjusts the temperature of said thermal unit to  
            maintain said reaction substrate at said first temperature and wherein said controller  
            adjusts the temperature of said head plate to maintain said head plate at said second  
            temperature.
- 25           4.     The apparatus of claim 1, further comprising a gas source in  
            communication with said headspace, wherein said gas source includes at least one gas.
5.     The apparatus of claim 1, wherein said adjustable pressure comprises a  
30     range of between about 1 atmosphere and about 50 atmosphere.

6. The apparatus of claim 5, wherein said adjustable pressure comprises a range of between about 1 atmosphere and about 45 atmosphere.

7. The apparatus of claim 6, wherein said adjustable pressure comprises a range of between about 1 atmosphere and about 20 atmosphere.

8. The apparatus of claim 1, further comprising at least one reactant system within at least one substrate reservoir, said reactant system being at least partially embodied in a liquid.

9. The apparatus of claim 8, wherein said at least one reactant system comprises a film having a thickness L.

10. The apparatus of claim 9, wherein said thickness L is sufficient to allow the reaction to be independent of the mass transport rate of a gas into said liquid.

11. The apparatus of claim 9, wherein said thickness L is independent of the effects of evaporation of said liquid.

12. The apparatus of claim 1, wherein at least one reactant is partially embodied in a gas.

13. The apparatus of claim 12, wherein said at least one reactant system comprises the atmosphere in said headspace.

14. An apparatus for the rapid screening of potential reactants, catalysts and reaction conditions, the apparatus comprising:  
a reaction substrate comprising a plurality of substrate reservoirs;  
a thermal unit in communication with said substrate reservoir to adjustably heat and cool said reaction substrate;

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18. The apparatus of claim 17, wherein said headspace comprises a pressure ranging from about 1 atmosphere to about 20 atmosphere.

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20. The apparatus of claim 19, wherein said thickness L is sufficient to allow the reaction to be independent of the mass transport rate of said gas into said liquid and evaporation of said liquid.

5 21. A method for rapid screening of potential reactants, catalysis and reaction conditions, the method comprising:  
adding a plurality of reactant systems at least partially embodied in liquid to a reaction substrate comprising a plurality of substrate reservoirs, wherein the reaction substrate has an adjustable first temperature;

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10 maintaining an adjustable pressure in a sealed headspace in communication with the reactant system;

adding a gas to the sealed headspace wherein the gas equilibrates with each of the plurality of liquid reactant systems; and

maintaining said headspace at a second temperature.

15 22. The method of claim 21, wherein the second temperature is greater than the first temperature.

20 23. The method of claim 21, further comprising providing an external controller, wherein the controller maintains the reaction substrate at said first temperature and the headspace at the second temperature.

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25 24. The method of claim 21, wherein said plurality of reactant systems each comprises reactants dissolved, suspended, submersed, or entrained in said liquid.

25 25. The method of claim 21, wherein the adjustable pressure in said sealed headspace is in the range of between about 1 atmosphere and about 50 atmosphere.

30 26. The method of claim 25, wherein the adjustable pressure in said sealed headspace is in the range of between about 1 atmosphere and about 45 atmosphere.

27. The method of claim 26, wherein the adjustable pressure in said sealed headspace is in the range of between about 1 atmosphere and about 20 atmosphere.

28. The method of claim 21, wherein at least one reactant system is partially embodied in said gas.

29. The method of claim 21, wherein the gaseous reactant comprises the atmosphere in the headspace over the reaction substrate.

30. The method of claim 21, wherein said plurality of reactant systems partially embodied in a liquid each comprises a film having a thickness L.

31. The method of claim 30, wherein said thickness L is sufficient to allow the reaction to be independent of the mass transport rate of a gaseous reactant into the liquid reactant system.

32. The method of claim 30, wherein said thickness L is sufficient to allow the reaction to be independent of effects of evaporation of the liquid reactant system.

33. A method for rapid screening of potential reactants, catalysis and reaction conditions, the method comprising:

adding a plurality of reactant systems to a reaction substrate, wherein the reaction substrate has an adjustable first temperature, and each of the plurality of reactant systems is at least partly embodied in a liquid film having a thickness L, wherein said thickness L is sufficient to allow the reaction to be independent of evaporation of the liquid film and the mass transport rate of a gas into the liquid;

maintaining an adjustable pressure in a sealed headspace in communication with the reactant system;

adding said gas to the sealed headspace, wherein said gas equilibrates with each of the plurality of liquid reactant systems; and

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maintaining the sealed headspace at an adjustable second temperature wherein the second temperature of the headspace is greater than the first temperature of the substrate reservoir;

5 34. The method of claim 33, further comprising externally controlling said first and second temperatures.

35. The method of claim 33, wherein said defined pressure in said enclosed headspace is in the range of between about 1 atmosphere and about 50 atmosphere.

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36. The method of claim 35, wherein said defined pressure in said enclosed headspace is in the range of between about 1 atmosphere and about 45 atmosphere.

37. The method of claim 36, wherein said defined pressure in said enclosed headspace is in the range of between about 1 atmosphere and about 20 atmosphere.

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38. The method of claim 33, further comprising at least one reactant partially embodied in said gas